EXPEDITE

#131

INFORMATION REPORT INFORMATION REPORT

CENTRAL INTELLIGENCE AGENCY

C-O-N-F-I-D-E-N-T-I-A-L
NOFORN

50X1-HUM

COUNTRY North Korea (Tungsten)

SUBJECT Underground Ore Dressing Plant, Mannyŏn Mine, Hwanghae-pukto (descrip of mine and processing of ore)

REPORT

DATE DISTR. 6 July 1961

NO. PAGES 2

REFERENCES

DATE OF INFO.

PLACE & DATE ACQ.

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THIS IS UNEVALUATED INFORMATION. SOURCE GRADINGS ARE DEFINITIVE. APPRAISAL OF CONTENT IS TENTATIVE.

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1. The underground ore dressing plant at the Mannyŏn Mine, located at CU 230103 in Koroso-ri, Sinp'yŏng-gun, Hwanghae-pukto,[1] was established as a defense against air attacks. The original ore dressing facilities were destroyed by bombing during the Korean War, and in 1952 a pilot plant was constructed capable of handling 300 tons of ore per day. In 1954 construction of the present facilities was initiated, with technicians from the Ministry of Metal Industry and workers from the Mannyŏn Mine doing the actual construction. When the facility was completed in 1957, it could process 1,000 tons of ore a day. In 1958, the capacity was increased to 1,200 tons of ore processed per day, or 2,000 tons of concentrated tungsten ore produced per year.

2. The walls of the plant were cut in gneiss and coated with reinforced concrete, 45 cm. thick. The refining process was a conventional hydraulic-gravity method[2] and the machinery and techniques were standard for this type of ore dressing. The process was as follows: (Specific items of machinery are keyed to the attachment to this report.)

   a. The ore entered the plant through a large storage hopper (1). It was then fed into two brake crushers (7) from which it went to a sorting area where waste ore was removed by hand from the sorting conveyor (14) and dropped through holes in the floor (15) into a waste disposal shaft (17) from which it was carried off by rail carts.

   b. From the hand-sorting conveyor the ore was then passed under electromagnets (18) which removed the magnetic ore,[3] and then

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into trommels (22) where it was separated by size of ore particles. From the trommel the ore moved to cone crushers (34) or roller crushers (41) where it was further pulverized. At the time the ore was discharged from these crushers, it was mixed with water and moved as a liquid mixture until it was removed as refined ore.

c. From this point the ore and water mixture, referred to as ore tailings, was passed into a second set of trommels (47) where the ore was again separated by size of ore particle. From these trommels the ore tailings went to jigs and hutch boxes (55, 56, 57) where the ore tailings mixture was agitated and the first refined tungsten ore removed to the drying area.

d. The remaining ore was then fed into a track conveyor (63) which again separated the ore by size of particle. From the conveyor it entered ball mills (69) which further pulverized the ore particles. From the ball mills the ore was fed to first-stage shaking tables (84, 85) where the solution of ore tailings was agitated; the heavier particles containing refined tungsten ore were removed to the drying area. These processes were repeated through four stages of shaking tables and through a second ball mill (90), and at each stage refined tungsten ore was removed. Between the first and second stage the solution was passed through a flotation machine (103) which utilized a chemical process to remove refined tungsten ore.

e. Since the ore moved in solution, settling tanks (73, 128) were used to settle out the very fine particles of ore which remained in the solution after processing.

3. [redacted] 50X1-HUM

[redacted] Attachment one is a sketch of the underground ore dressing plant with appropriate keys and showing cross sections. Attachment two consists of twelve drawings of the machinery used in the plant.

[redacted] Comments

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[redacted]

2. In simplified terms this involved reducing the crude ore to find particles which were then placed in a liquid, usually water, and agitated. The particles containing tungsten were the heaviest and settled to the bottom of the solution and were removed.

3. According to available technical references, this may have been cassiterite (SnO_2).

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[redacted]

KEY TO ORE DRESSING PLANT

1. Hopper for receiving crude ore
2. Inclined surface at bottom of hopper
3. Chute and chain conveyor
4. Belt conveyor
5. Conveyor motor and reduction gear
6. Hopper to feed brake crushers
7. Brake crusher
8. Motor for brake crusher, 60 hp.
9. Service shaft
10. Conveyor belt
11. Stairs
12. Ore storage area
13. Chute from conveyor to sorting conveyors
14. Hand-sorting conveyor
15. Waste ore disposal chutes
16. Waste storage area
17. Waste ore disposal shaft
18. Electromagnets
19. Stairs
20. Ore storage
21. Chutes to trommels
22. Trommel
23. Motor for trommel, 5 hp.
24. Reduction gear for trommel motor
25. Service shaft
26. Water tank
27. Service shaft
28. Belt conveyor
29. Stairs
30. Belt conveyor
31. Tripper conveyor
32. Ore storage
33. Belt conveyor
34. Cone crushers
35. Motor for cone crusher, 40 hp.
36. Belt conveyor
37. Belt conveyor
38. Tripper conveyor
39. Ore storage
40. Belt conveyor
41. Roller crushers
42. Stairs
43. Belt conveyor
44. Belt conveyor (tube)
45. Chutes to trommels
46. Belt conveyor
47. Trommel
48. Belt conveyor
49. Belt conveyor
50. Chutes to jigs
51. Service shaft
52. Service shaft
53. Stairs
54. Tube to jig and hutch box

KEY TO ORE DRESSING PLANT (CONTINUED)

55. Jigs and hutch boxes
56. Jigs and hutch boxes
57. Jigs and hutch boxes
58. Hand concentration area
59. Service shaft to tungsten drying area
60. Service shaft to tungsten drying area
61. Stairs
62. Ore supply tube for track conveyor
63. Track conveyor
64. Motor and reduction gear for track conveyor, 10 hp.
65. Drive belt for track conveyor
66. Tripper conveyor
67. Ore storage for ball mills
68. Conveyor belts to ball mills
69. Ball mills, 8 ft
70. Motor for ball mills, 70 hp.
71. Ore tailings return tube
72. Ore tailings return tube
73. Settling tank
74. Tube to distributing machine
75. Tube to distributing machine
76. Conveyor belt
77. Stairs
78. Distributing machine
79. Service shaft to tungsten drying area
80. Control room
81. Control panel
82. Transformers
83. Control room office
84. First-stage shaking tables
85. First-stage shaking tables
86. Shaking table motor and gear box with eccentric, 5 hp.
87. Shaking Table motor and gear box with eccentric, 5 hp.
88. Tube to distributing machine
89. Motor for ball mill, 40 hp.
90. Ball mill, 6 ft
91. Stairs
92. Stairs
93. Service shaft to tungsten drying area
94. Stairs
95. Tank and tube to flotation machines
96. Tube to distributing machine
97. Distributing machine
98. Stairs
99. Service shaft to tungsten drying area
100. Second-stage shaking table motor and gear box with eccentric
101. Second-stage shaking table motor and gear box with eccentric
102. Second-stage shaking table
103. Flotation machine
104. Second-stage shaking table
105. Service shaft to tungsten drying area
106. Stairs
107. Tube to distributing machine

KEY TO ORE DRESSING PLANT (CONTINUED)

108. Distributing machine
109. Third-stage shaking table
110. Third-stage shaking table motor and gear box with eccentric
111. Third-stage shaking table motor and gear box with eccentric
112. Third-stage shaking table
113. Service shaft to tungsten drying area
114. Service shaft to tungsten drying area
115. Stairs
116. Fourth-stage shaking table
117. Distributing machine
118. Fourth-stage shaking table
119. Shaking table motor, 5 hp. and eccentric
120. Shaking table motor, 5 hp. and eccentric
121. Service shaft to tungsten drying area
122. Gurard quarters
123. Guardroom
124. Service shaft to tungsten drying area
125. Propaganda and meeting area
126. Conduit to carpet ground
127. Blanket sluice
128. Settling tank
129. Discharge conduit
130. Conduit under road

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KEY TO CROSS SECTION OF ORE DRESSING PLANT (C-D)

1. Mouth of hopper
2. Hopper for receiving ore
3. Reinforced concrete shell
4. Chain conveyor
5. Conveyor belt
6. Hopper to feed brake crusher
7. Overhead crane
8. Brake crusher
9. Motor for brake crusher
10. Conveyor
11. Hopper to feed hand concentration area
12. Chute to feed hand concentration area
13. Conveyor in hand sorting area
14. Electromagnet
15. Waste ore storage
16. Waste ore disposal chutes
17. Chute to waste ore disposal shaft
18. Waste ore disposal shaft and rail carts
19. Hopper to feed trommel
20. Trommel
21. Chute to water conduit
22. Chute to belt conveyor
23. Chute to belt conveyor
24. Belt conveyor
25. Water conduit to track conveyor
26. Stairs
27. Overhead crane
28. Roller crusher
29. Chute to cone crusher
30. Cone crusher
31. Cone crusher motors
32. Belt conveyor
33. Belt conveyor
34. Hopper to trommel
35. Conveyor belt
36. Trommel
37. Belt conveyor
38. Chute to conduit
39. Conduit
40. Hopper and chutes to jigs
41. Jigs
42. Conduit to track conveyor
43. Stairs
44. Track conveyor
45. Tripper conveyor
46. Ball mill ore storage
47. Chute to belt conveyor
48. Belt conveyor
49. Stairs
50. Overhead crane
51. Ball mill
52. Conduit to distributing machine
53. Stairs
54. Distributing machine

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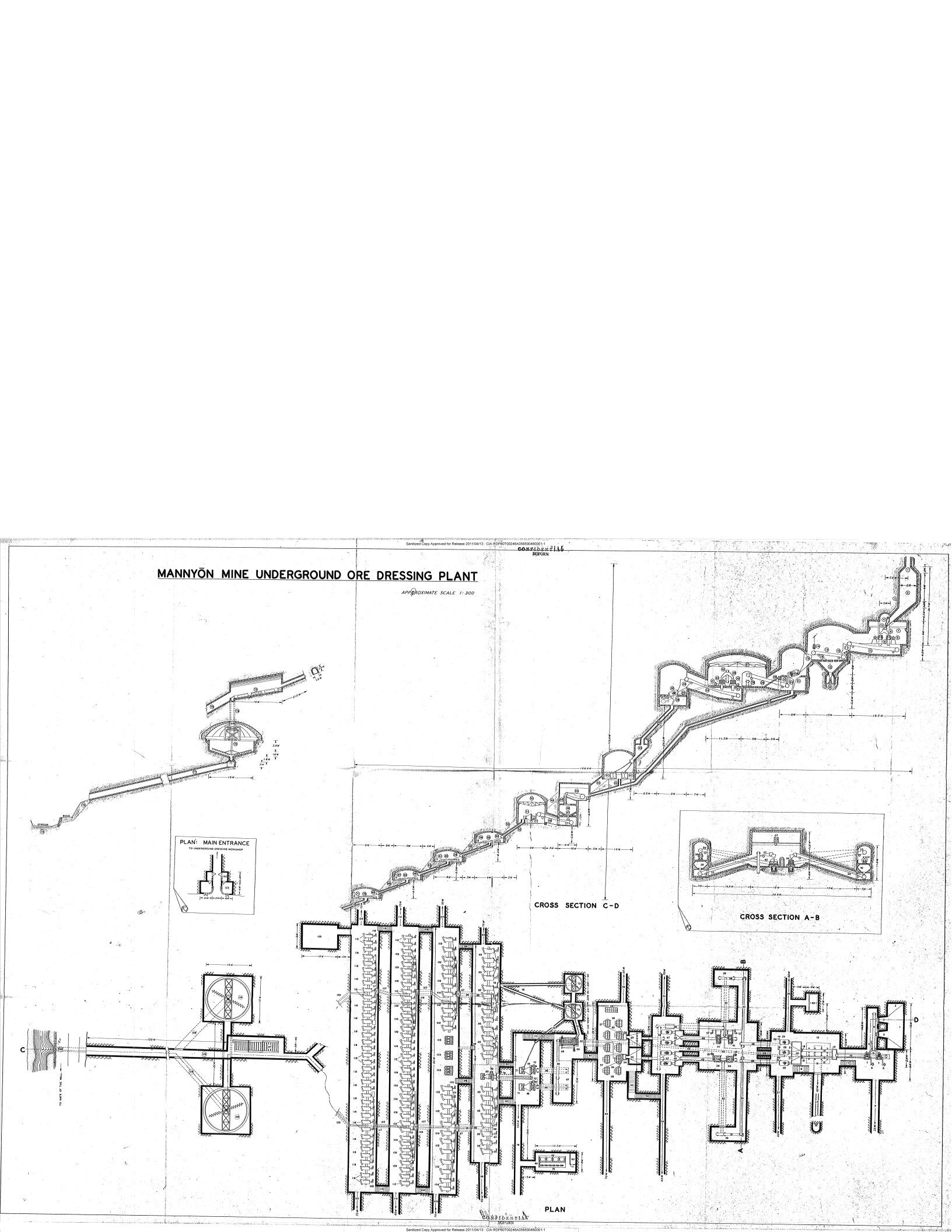
KEY TO CROSS SECTION OF ORE DRESSING PLANT (C-D) (CONTINUED)

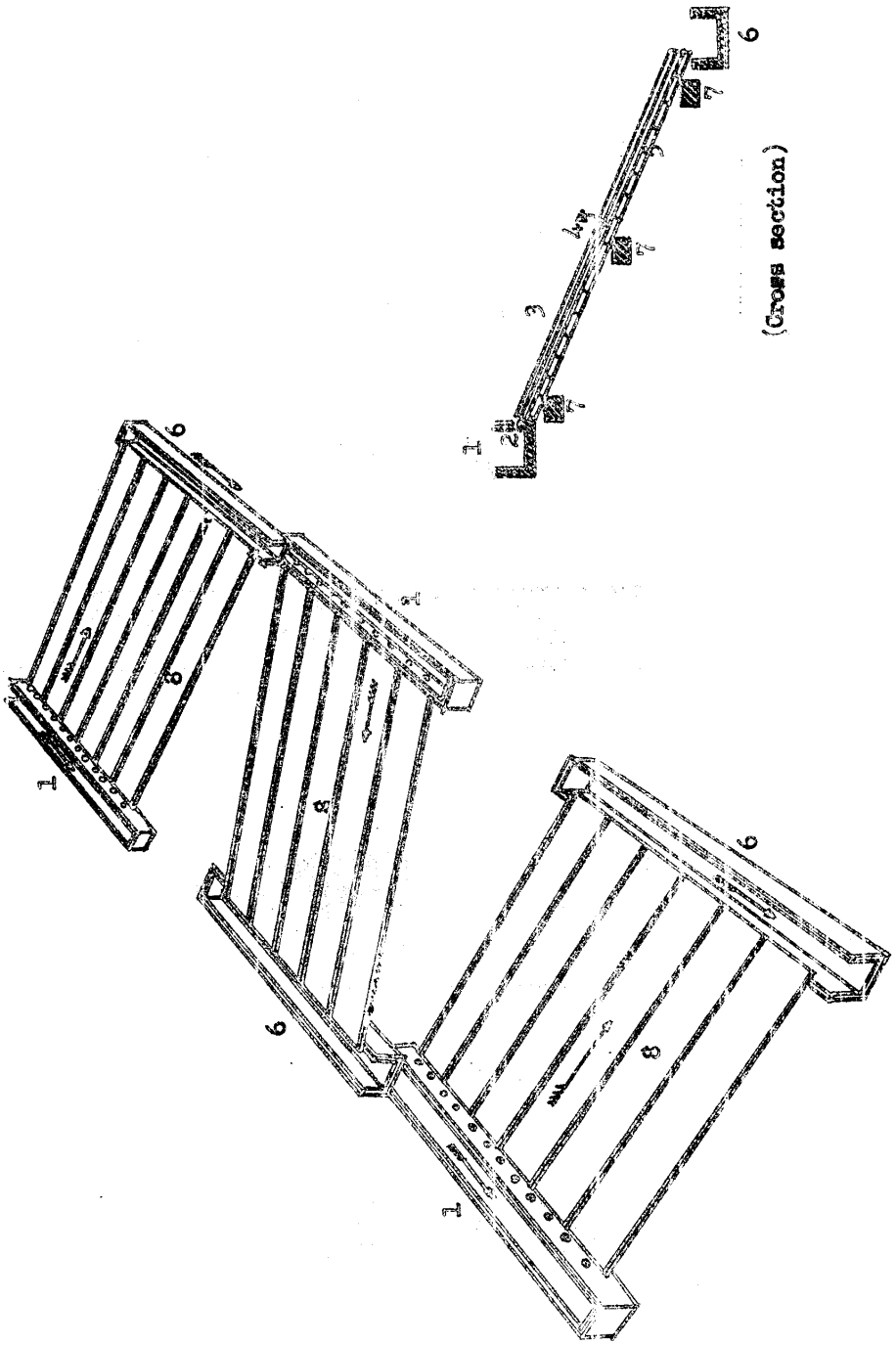
55. First-stage shaking tables
56. Hanging bucket
57. Conduit to second-stage shaking tables
58. Stairs
59. Distributing machine
60. Second-stage shaking tables
61. Hanging buckets
62. Conduit to third-stage shaking tables
63. Stairs
64. Distributing machine
65. Third-stage shaking tables
66. Conduit to fourth-stage shaking table
67. Hanging bucket
68. Stairs
69. Distributing machine
70. Fourth-stage shaking table
71. Hanging bucket
72. Conduit to carpet ground
73. Carpet ground
74. Conduit to settling tank
75. Discharge conduit to river
76. Settling tank
77. Discharge tube to river
78. Conduit under road
79. Stream

MANNYŌN MINE UNDERGROUND ORE DRESSING PLANT

APPROXIMATE SCALE 1:300



Sketch of Blanket Board



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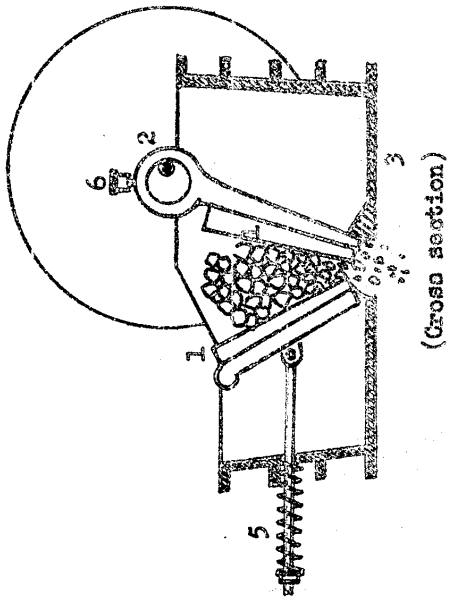
Explanations to Sketch

1. Ore-suppling Water tube
2. Ore outlet
3. Wood frame around blanket board
4. Blanket
5. Wood board
6. Ore-receiving tube
7. Support
8. Blanket board

Sketch of Blake type Crusher



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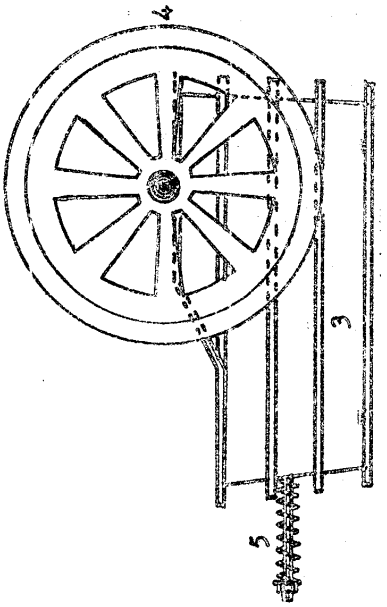
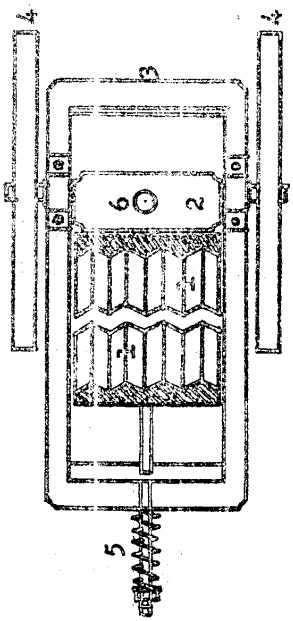


(Side view)



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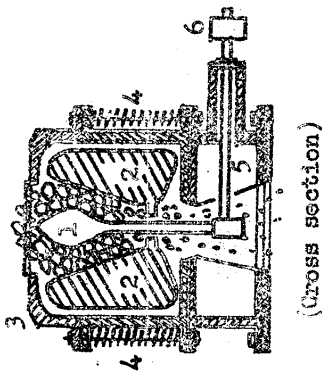
Explanations to Sketch

1. Jaw
2. Shaking shaft
3. Housing
4. Pulley
5. Adjusting spring and shaft
6. Grease cap

Sketch of Cone Crusher



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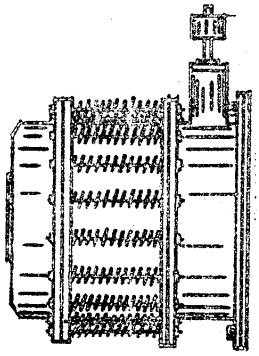

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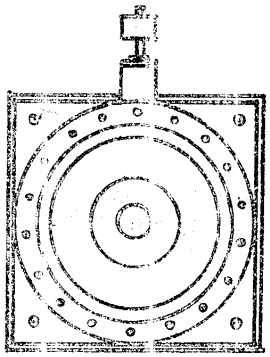

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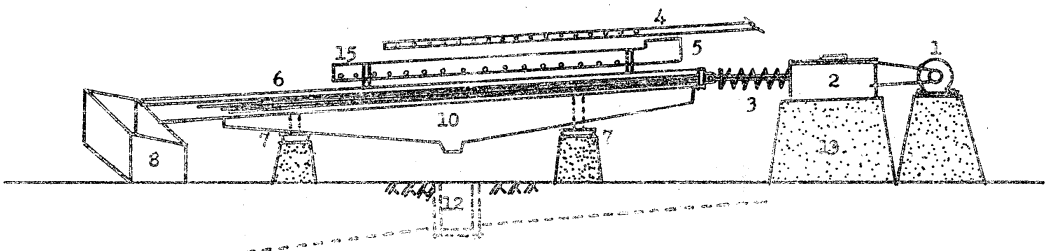
Explanations to Sketch

1. Cone (cast iron)
2. Concave
3. Housing
4. Spring and bolt
5. Revolving shaft
6. Pulley
7. Anchor

Sketch of Shaking table



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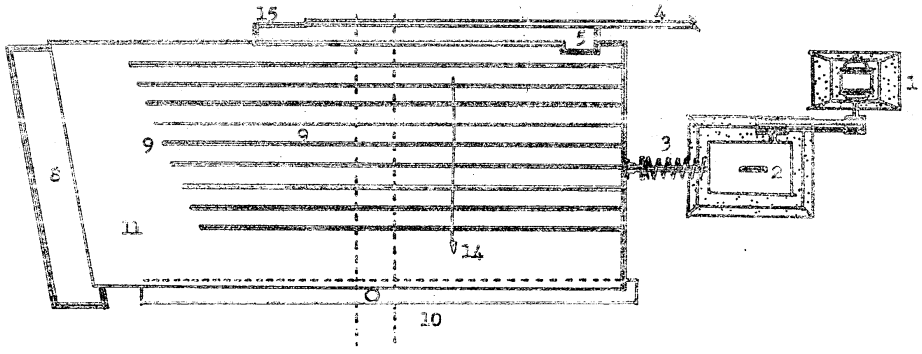
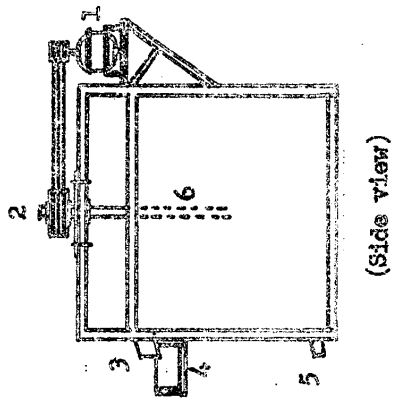


(Plan)

Explanations to Sketch

1. Motor
2. Transmission
3. Shaking spring
4. Water sprayer
5. Ore receiving tube
6. Table board
7. Shaking roller and plate
8. Tank of half-dressed
9. Grooves
10. Ore receiving tube
11. Linoleum sheet
12. Concrete water tube
13. Machine base
14. Dressing direction
15. Washing tank

Sketch of Flotation Machine



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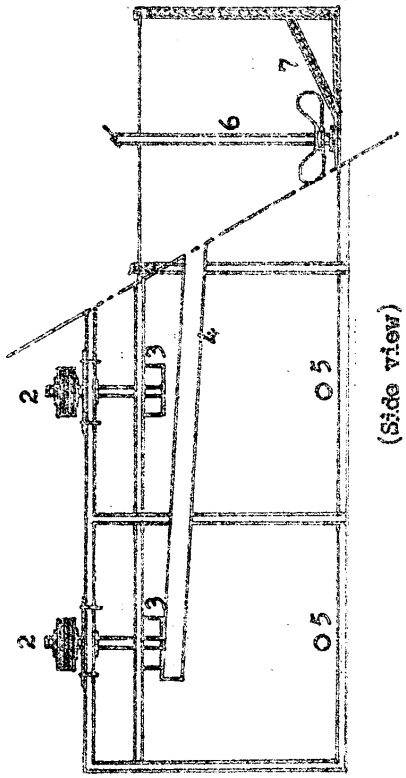

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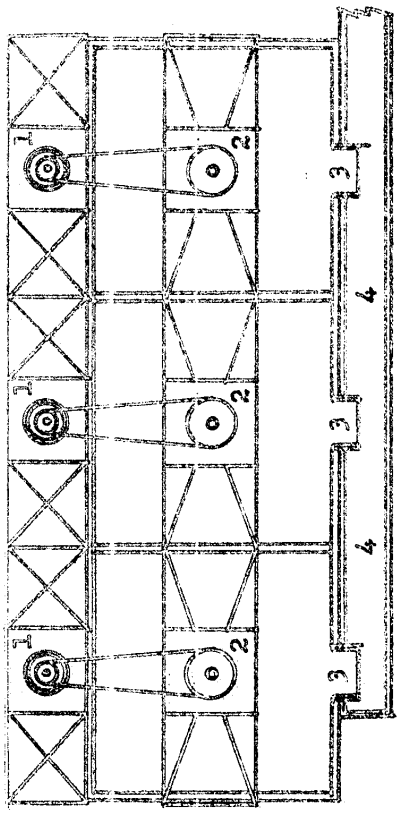

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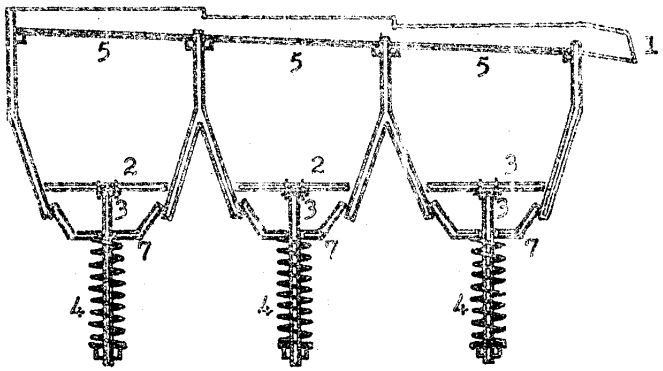
Explanations to Sketch

1. Motor
2. Pulley
3. Over chute
4. Water tube
5. Concentrate outlet
6. Propeller shaft
7. Cast iron support

Sketch of Classifier



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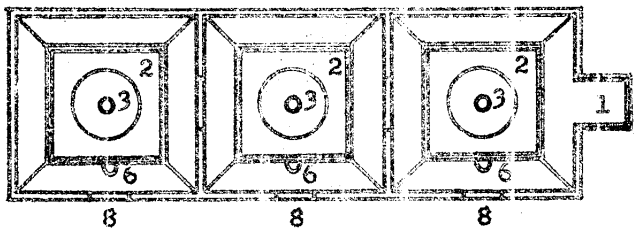

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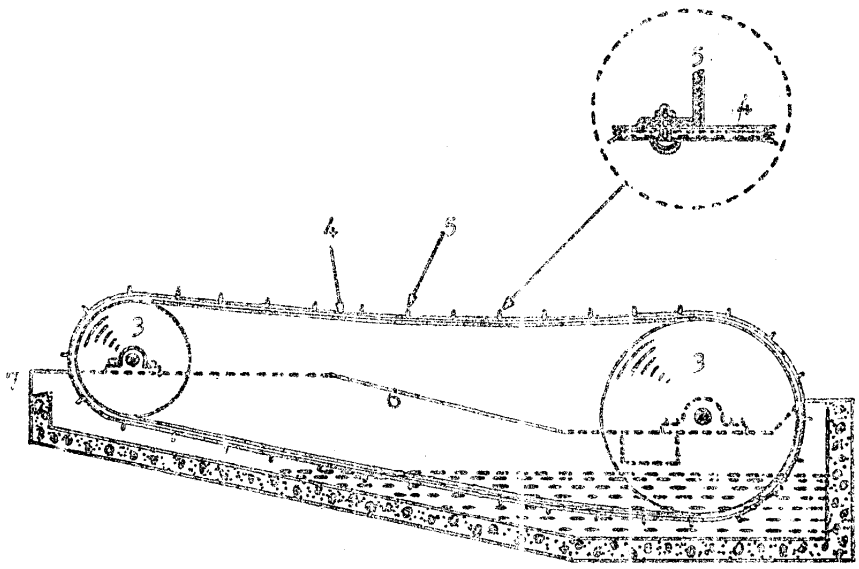
Explanations to Sketch

1. Tailings inlet chute
2. Rubber diaphragm
3. Spring shaft
4. Spring
5. Screen
6. Sunk ore outlet
7. Spring pad
8. Over chute

Sketch of Track conveyer



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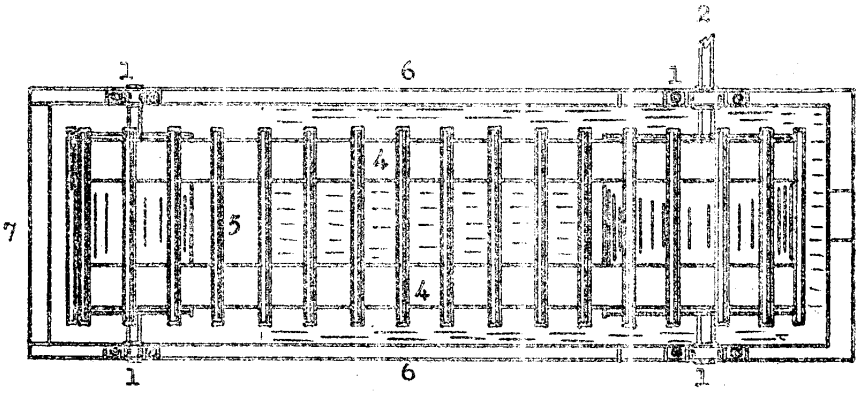

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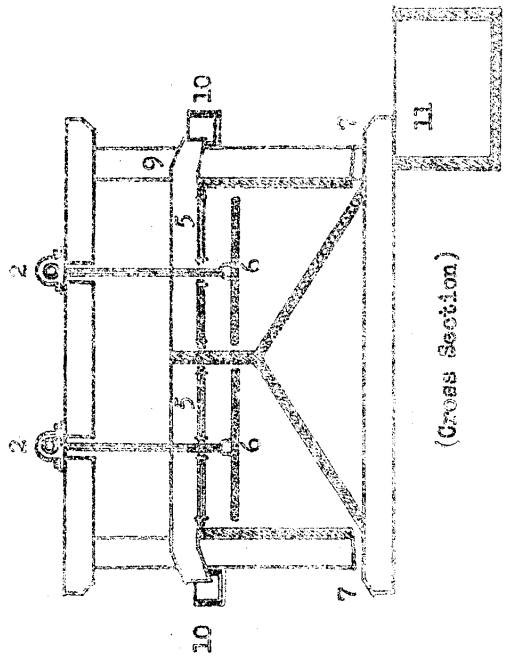
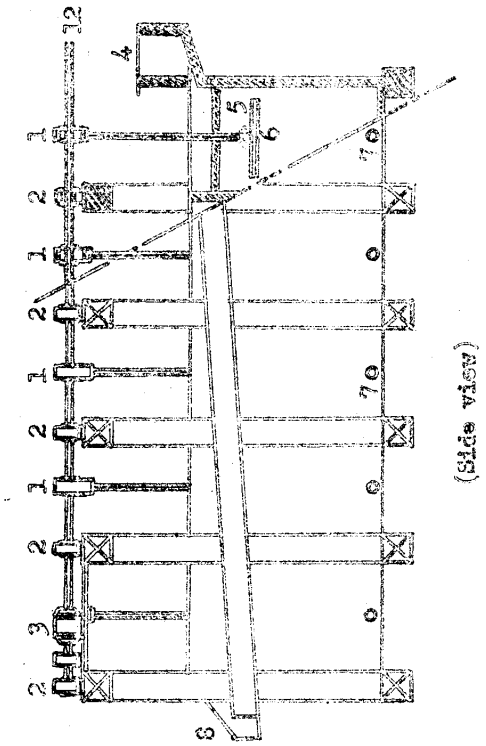
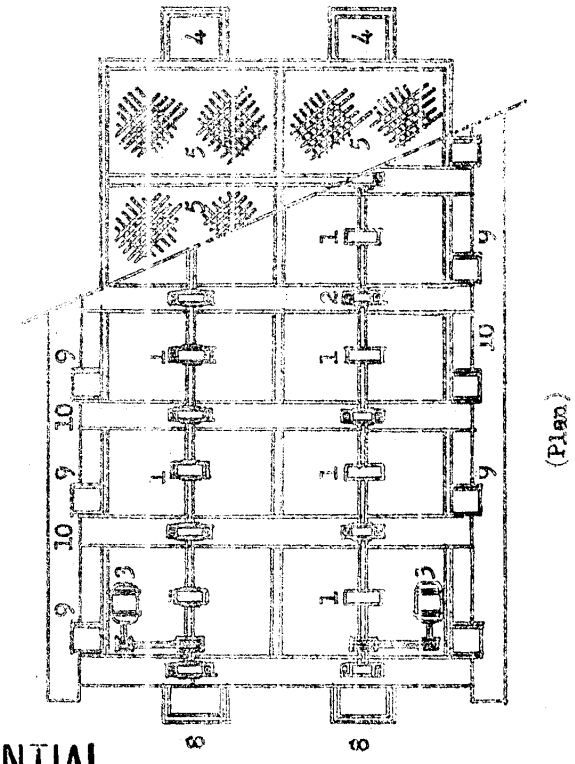
Explanations to Sketch

1. Pillow block
2. Shaft
3. Immitation drum
4. Belt
5. Rake (angle)
6. Concrete
7. Tailings outlet

Sketch of Jig







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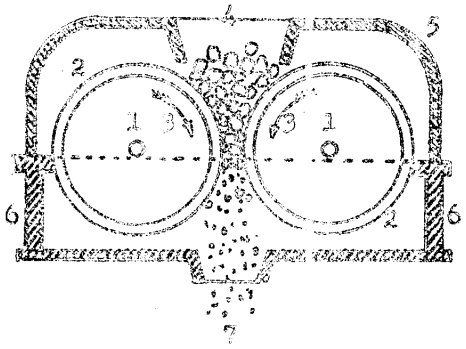
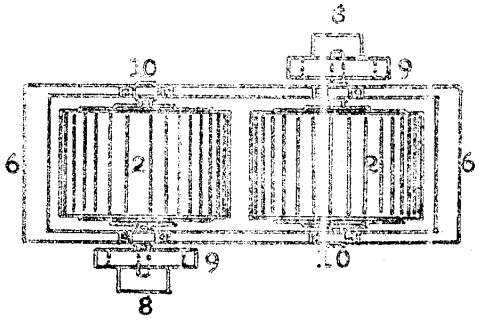
Explanations to Sketch

1. Eccentric shaft
2. Pillow block
3. Motor
4. Ore receiving tube
5. 1.5 to 2mm sieve
6. Plunger
7. Hutch outlet
8. Ore outlet
9. Concentrate outlet
10. Water tube receiving concentrate
11. Hutch tank
12. Shaft

Sketch of Roll Crusher





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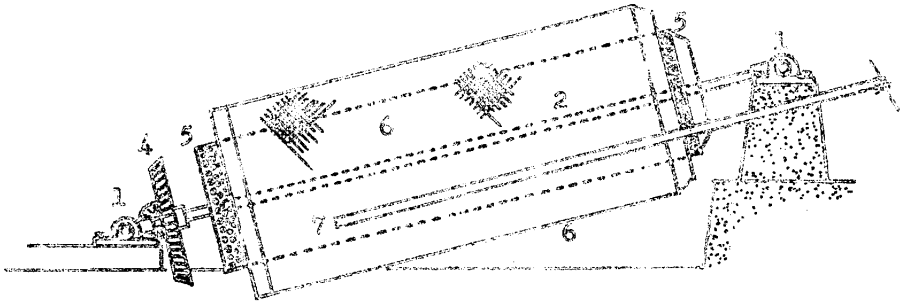
Explanations to Sketch

1. Roller shaft
2. Roller tire (to be replaced frequently)
3. Direction
4. Ore inlet
5. Roller cover
6. Housing
7. Ore outlet
8. Belt pulley
9. Flywheel
10. Pillow block

Sketch of Trowel



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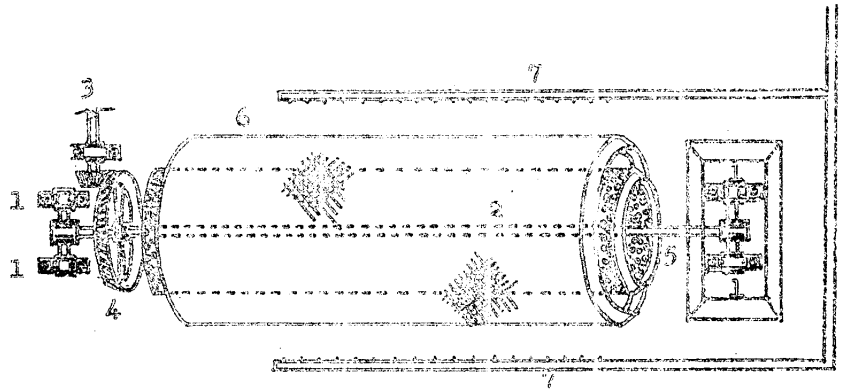

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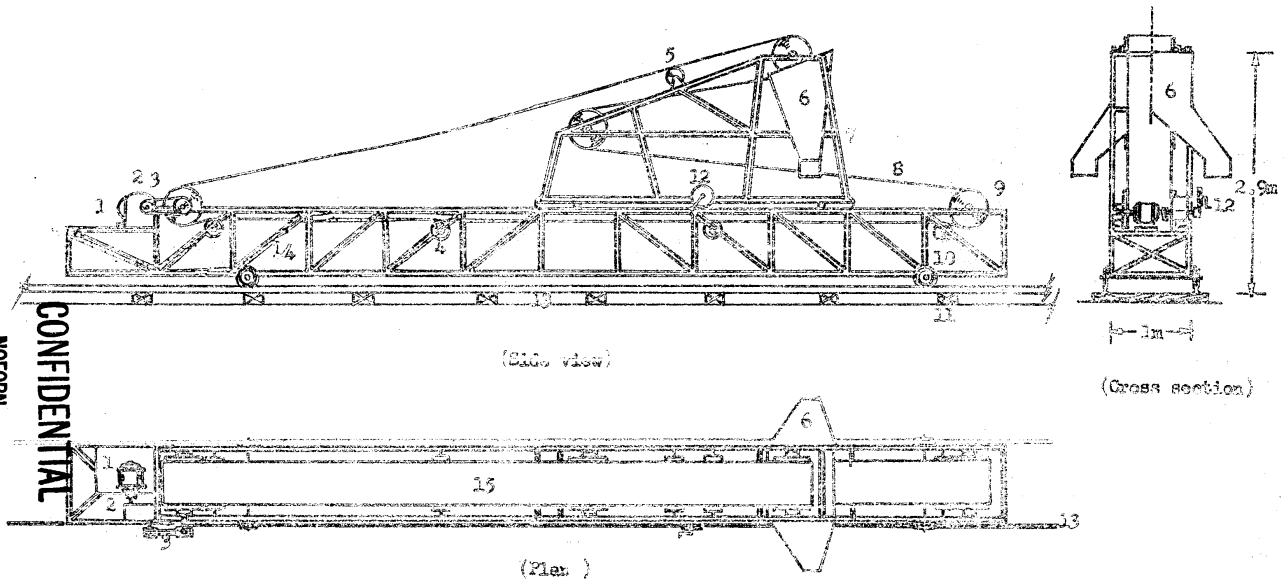
Explanations to Sketch

1. Metal
2. Shaft
3. Bevel gear and shaft
4. worm gear
5. Interior sieve
6. Exterior sieve
7. Clean-Water pipe

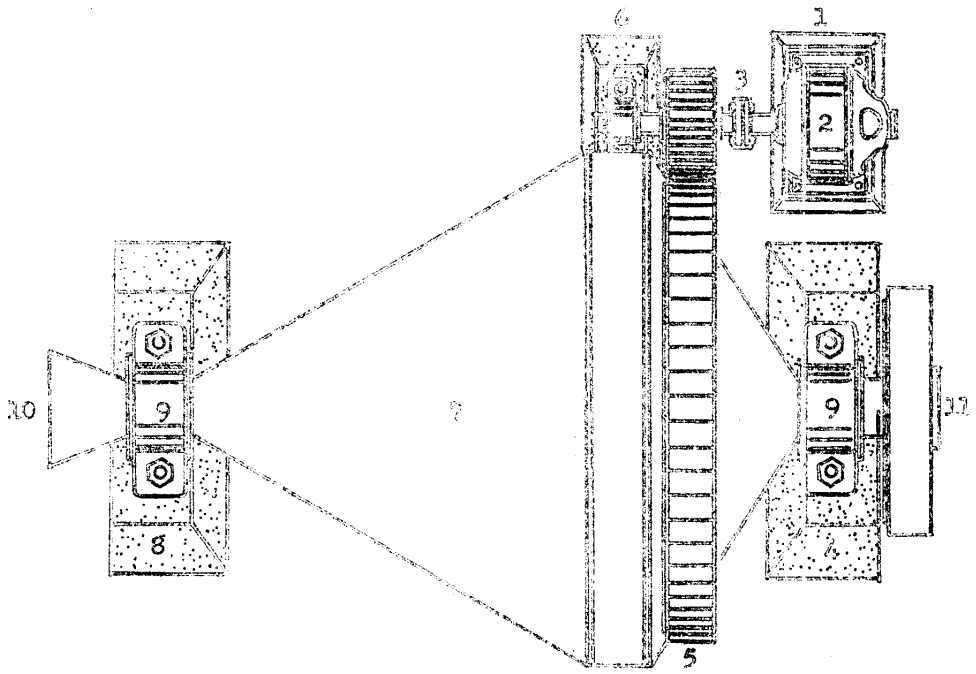
Sketch of Tripper conveyer



Explanations to Sketch

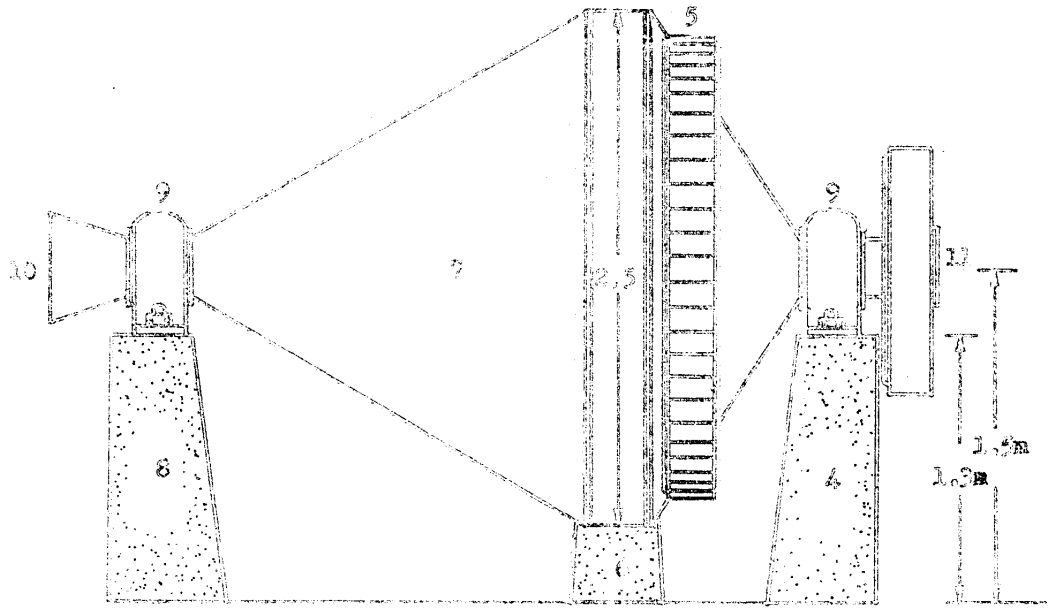
1. Motor
2. Decelerator
3. V-belt
4. Roller preventing the conveyer from sagging
5. Carrier
6. Iron chute
7. Moving table
8. Conveyer
9. Drum (turns)
10. Moving wheel
11. Tie
12. Drive crank
13. Rail
14. Angle
15. Belt

Sketch of Ball Mill



(Plan)

(Side View)



Scale 1/30

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Explanations to Sketch

1. Motor base
2. Motor
3. Flange
4. Concrete base
5. Shell gear
6. Intermediary shaft metal
7. Shell
8. Front shell metal base
9. Shell metal
10. Base opening
11. Ore-suppling hopper